CORS Industry Forum
National Geodetic Survey
National Ocean Service, NOAA
March 26, 2001

Initial Response to Forum Feedback

Over the next few months, we (the NGS staff) will be discussing the feedback provided by our CORS (Continuously Operating Reference Station) partners during the recent CORS Industry Forum with the intent of forming a plan of action. Meanwhile, this report presents some initial thoughts on the feedback so as to promote continued interaction between our partners and us on improving the National and Cooperative CORS programs. We welcome your comments on this document as we plan for the future of CORS.

We find the complimentary responses to the question "What's working well?" most gratifying. When we polled several CORS users in 1998, more than half of the replies complained about the difficulty of working with CORS data. Consequently, we developed the UFCORS and CORSAGE utilities, we extended online accessability of CORS data from 30 days to several years, and we instituted an email address (cors@ngs.noaa.gov) and a telephone line (301-713-3563) where people could pose CORS-related questions and obtain timely responses. Thanks to these and other efforts, the perception of CORS has dramatically changed from "difficult to work with" to "user friendly" in less than 3 years. We anticipate that our most recent initiatives, namely, the establishment of the Cooperative CORS program and the creation of OPUS (Online Positioning User Service), will generate an even greater impact.

The responses to the questions "What's not working well?" and "What needs exist?" identify several strategic "needs" including:

> * developing standards/specifications,
> * educating users,
> * densifying the CORS network, and
> * integrating the National and Cooperative CORS into a seamless network.

While NGS and its CORS partners are already involved in developing standards/specifications and educating users, Forum participants have indicated that the level of effort should be increased--especially in the areas of formatting data, processing data, performing field operations, establishing CORS sites, and designing Internet-based data distribution facilities. NGS and its CORS partners must dedicate even more resources towards developing standards/specifications and educating users, mainly because technological advances are occurring ever more rapidly. To keep pace with these advances, procedures and educational materials must be continually revised.

Technological advances also affect the "need to densify" the CORS network. If we assume, for example, that our eventual goal is to provide real-time, centimeter-level positioning, then we could have achieved this goal a year ago with a CORS network comprised of RTK base stations spaced about 10 km apart. Today, however, Switzerland has achieved this goal with a network of GPS base stations spaced about 50 km apart. (GPS data from the Swiss base stations are transmitted to a central facility where spatial variations in systematic errors--like atmospheric refraction-- are determined via interpolation/modeling to provide more accurate "data correctors" to roving GPS receivers.) Perhaps in a few years, technology will enable us to achieve real-time, centimeter-level positioning using a network of base stations spaced more than 100 km apart. Indeed, NASA's Jet Propulsion Laboratory has already announced the capability to obtain real-time, decimeter-level positioning using only 18 globally distributed GPS base stations. Hence, the "need to densify" might be better phrased as a "need to upgrade" the CORS network as technology warrants.

NGS initiated the Cooperative CORS network in large part because we realized that the number of institutions establishing GPS base stations in the United States would greatly exceed NGS' capacity to effectively interact with each such institution to the extent necessary if all these stations were included in the National CORS network. As it now stands, NGS interacts with more than 30 institutions, each of which operates at least one National CORS site. Even at this level of involvement, NGS finds it difficult to keep abreast of those changes that pertain to CORS operations at each of the 30+ institutions--in particular, changes in site health, key personnel, equipment, software, communications, and institutional policies. Hence, NGS looks to Cooperative CORS institutions to directly shoulder the responsibility to inform the public about such changes. This

responsibility, together with the responsibility for the Cooperative CORS institution to establish an efficient data distribution facility, represents a significant burden which many find overwhelming. As a result, NGS has been extremely lenient thus far in imposing additional burdens upon participating Cooperative CORS institutions, primarily to get the program off the ground. Nevertheless, because the NGS staff appreciates the benefits of uniformity, we will work with private industry and our other CORS partners during the next few years to develop better guidelines and tools for operating Cooperative CORS sites. Fortunately, some GPS vendors are actively developing tools to enable States and other institutions to establish and maintain regional CORS networks more easily than before. Also, OPUS will enable the Cooperative CORS institutions to monitor data quality more effectively.

Responses to the question "How could CORS information be used?" suggest a desire for CORS information to support various real-time applications. In fact, NGS is already working closely with the U.S. Department of Transportation in exploring methods for upgrading the current DGPS/NDGPS service to provide real-time positioning at an accuracy of a few centimeters. Such an upgrade may be viewed as a marriage between current DGPS and CORS activities. Some "proof-of-concept" experiments are scheduled for this year. We will also need to explore the respective roles that government, academia, and private industry should play in providing such a service to the public, should the service become practicable. Because this and other CORS considerations will require close cooperation between government agencies, academia, and private industry; NGS plans to host additional CORS Industry Forums in the future. Our current thought is to host one in the spring of 2002 in conjunction with either the CGSIC or the FIG meeting, both of which are scheduled for the Washington, D.C., area. We are considering the theme "Establishing and Maintaining a Regional CORS Subnetwork" because many of this year's Forum participants represented States or other institutions interested in this topic. As always, NGS welcomes your input on these and other CORS considerations.

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The CORS Team
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